[Translation from German]

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Claims

1. Lamp, in particular a tail light, for vehicles, preferably motor vehicles, having a housing in which at least one light source is arranged, located behind a light disk and associated with at least one reflection part, characterized in that the light source provided is an LED (2) emitting its light (L, L') laterally and surrounded by the reflection part (1, 1a, 1a', 1b).

2. Lamp according to claim 1, characterized in that the height of the reflection part (1, 1a, 1a', 1b) corresponds essentially to the height of the LED (2).

3. Lamp according to claim 1 or 2, characterized in that the reflection part (1) is a reflector.

4. Lamp according to claim 3, characterized in that the reflector (1) is of parabolic configuration.

5. Lamp according to claim 3 or 4, characterized in that the LED (2) is arranged at the focus of the reflector (1).

6. Lamp according to any of claims 3 to 5, characterized in that the reflector (1) is provided with optics (11) at its reflector surface (6).

7. Lamp according to claim 1 or 2, characterized in that the reflection part (1a, 1a', 1b) is a light-conducting element.

8. Lamp according to claim 7, characterized in that the light-conducting element (1a, 1a', 1b) has a circular outline, at least on the light exit side (15).

9. Lamp according to claim 7 or 8, characterized in that the light-conducting element (1a, 1a', 1b) comprises a central aperture (13) in which the LED (2) is located.

10. Lamp according to any of claims 7 to 9, characterized in that the light-conducting element (1a, 1a', 1b) comprises reflection surfaces (8, 8') reflecting the light (L, L') emitted by the LED (2) to the light exit surface (15).

11. Lamp according to claim 10, characterized in that the reflection surfaces (8, 8') are provided coaxial to the LED (2).

12. Lamp according to claim 10 or 11, characterized in that the reflection surfaces (8, 8') are provided on the under side (7, 7b) of the light-conducting element (1, 1a', 1b), opposed to the light exit surface (15).

13. Lamp according to any of claims 7 to 12, characterized in that the outside (9) of the light-conducting element (1a, 1a', 1b) is provided with at least one reflection layer, preferably applied by vapor deposition.

14. Lamp according to any of claims 1 to 13, characterized in that at least two reflection parts (1, 1a, 1a', 1b) are arranged closely spaced one behind another in the beam direction of their LEDs (2).

15. Lamp according to claim 14, characterized in that one reflection part (1) is a reflector and the other reflection part (1a, 1a', 1b) is a light-conducting element.

16. Lamp according to claim 15, characterized in that the reflector (1) is located ahead of the light-conducting element (1a) in beam direction.

17. Lamp according to claim 16, characterized in that the reflector (1) comprises a passage opening (12) to admit the rays (L') of the light-conducting element (1a).

18. Lamp according to claim 15, characterized in that the reflector (1) is located behind the light-conducting element (1a) in beam direction.

19. Lamp according to claim 18, characterized in that the rays (L) reflected by the reflector (1) enter the light-conducting element (1a) between the reflection surfaces (8).

20. Lamp according to claim 19, characterized in that the light rays (L) of the reflector (1) impinge perpendicularly on the under side (7) of the light-conducting element (1a).

21. Lamp according to claim 14, characterized in that two light-conducting elements (1a, 1a') are arranged one behind the other in beam direction.

22. Lamp according to claim 21, characterized in that the rays of light (L') reflected from the rearward light-conducting element (1a') enter the anterior light-conducting element (1) in the region between the reflection surfaces (8).

23. Lamp according to claim 22, characterized in that the light rays (L') of the rearward light-conducting element (1a') impinge perpendicularly on the under side (7) of the anterior light-conducting element (1a).

24. Lamp according to any of claims 1 to 23, characterized in that at the rear (7) of the reflection part (1a, 1a', 1b), at least one cooling member (10, 10b) is provided.

25. Lamp according to claim 24, characterized in that the cooling member (10, 10b) at least partially covers the under side (7) of the reflection part (1a, 1a', 1b).

26. Lamp according to any of claims 14 to 25, characterized in that the LEDs (2) of the reflection parts (1, 1a, 1a', 1b) arranged one behind another emit the same chromatic hue.

27. Lamp according to any of claims 14 to 25, characterized in that the LEDs (2) of the reflection parts (1, 1a, 1a', 1b) arranged one behind another emit different chromatic hues.

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Lamp, in Particular a Tail Light, for Vehicles, Preferably Motor Vehicles

The invention relates to a lamp, in particular a tail light, for vehicles, preferably motor vehicles, according to the generic clause of Claim 1.

In a known lamp of this kind (DE 195 47 861), an incandescent lamp is arranged in the housing behind the light disk in a larger chamber and an LED behind a light-conducting element in a smaller chamber. The LED emits towards the light disk. The reflection part is arranged in front of the LED. Hence, the lamp has a corresponding structural depth.

The object of the invention is so to configure a lamp of this kind that it will have but little structural depth and a high optical efficiency.

This object is accomplished according to the invention in a lamp of this generic kind by the characterizing features of Claim 1.

In the lamp according to the invention, the LED emits its light to a large extent laterally. The reflection part surrounding the LED picks up this light completely and reflects it towards the light disk of the lamp. The height of the reflection part can therefore correspond to the height of the LED. As a result, the reflection part and hence the lamp has but little structural height, so that the lamp can be accommodated in flat installation spaces without problems. Even so, an optimal emission of light is achieved, since the reflection part picks up almost

100% of the quantity of light emitted by the LED and reflects it towards the light disk. Furthermore, it will suffice to use only a single LED. Hence, the lamp can be simply and economically produced.

Other features of the invention will appear from the additional claims, the description of the figures, and the drawings.

The invention will be described in more detail below in terms of several embodiments shown in the drawings by way of example. In the drawings:

Fig. 1 shows a part of a lamp according to the invention having a luminous medium and a reflector in axial section,

Figs. 2 to 6 each show another embodiment according to the invention of a lamp part represented as in Fig. 1.

Fig. 1 shows part of a motor vehicle tail light having a parabolic reflector 1, at the focus of which the luminous means 2, in the form of an LED 2, is arranged. The reflector 1 and the LED 2 are provided in a housing (not shown) of the tail light, having a housing aperture closed in known manner with a light disk (likewise not shown) through which the light exits to the outside. The LED 2 is seated on a base 3 held to the housing. The LED 2 has a light-conducting element 4 more or less in the shape of a double cone, and encircling ribs 5 projecting outward at half-height, at which the light rays L leaving the LED 2 are so deflected laterally that almost all of the light is emitted laterally. Such LEDs are known and therefore need not be described in more detail. The reflector 1 is drawn up so far that all light rays L reach the inside 6 of the reflector 1 and are reflected to the light disk of the lamp. In the embodiment by

way of example, the light rays L are reflected parallel to each other and impinge on the light disk perpendicularly.

The reflector surface 6 is of smooth configuration. Alternatively, however, it may exhibit so-called cushion and/or roller structure, at which the incident rays L are scattered. Again, it is possible to arrange an optical disk in the region between the reflector 1 and the light disk.

Since the LED 2 emits light laterally only, the reflector 1 may be of flat construction. Thus an optimal light yield of nearly 100% is possible. The LED 2 has a long life, is inexpensive, and develops but little heat as a rule.

As shown in Fig. 2, instead of a reflector a light-conducting element 1a may be provided. The LED 2 is seated in its central aperture 12. The light-conducting element 1a has a circular outline and but little thickness. The LED 2 projects only slightly beyond the element 1a. The ribs 5 of the LED are of such configuration that they deflect the light rays L obliquely downward at a flat angle. The light rays L exiting beyond the compass of the two ribs 5 in accordance with the previous embodiment enter the element 1a and arrive at the reflection surfaces 8 extending annularly about the axis 14 of the element 1a and enclosing an acute angle opening towards the light exit side 15 of the element with the axis 14. The reflection surfaces 8 lie parallel to each other and are connected to each other by annular surfaces 16 inclined contrary to them. The reflection and annular surfaces 8, 16 are provided on the under side 7 of the element 1a opposed to the light exit side 15, which element 1a is of

trapezoidal cross-section. The light exit side 15 has a greater diameter than the under side 7.

The light rays L emanating from the LED 2 are so reflected at the reflection surfaces 8 that they exit parallel to each other perpendicularly from the light exit side 15 of the element 1a. The reflection surfaces 8 may alternatively be so arranged and configured that the light rays L do not run parallel to each other after reflection.

In this embodiment also, essentially all of the light emanating from the LED 2 is picked up by the element 1a. It has but little thickness, corresponding substantially to the height of the LED 2. The element 1a is therefore eminently suitable if but little installation depth is available.

As Fig. 3 shows, the light-conducting element 1a according to Fig. 2 may be combined with a reflector 1 according to Fig. 1. The element 1a lies a short distance behind the reflector 1 in beam direction, at the level of a central aperture 12 through which the LED 2 projects. The diameter of this aperture 12 matches the diameter of the light-conducting element 1a on the light exit side 15.

The LED 2 of the light-conducting element 1a is located behind the LED 2 of the reflector 1. The reflection surfaces 8 of the element 1a are so arranged that the light L' coupled into the element 1a from the LED 2 reaches through the aperture 12 of the reflector 1. The rays of light L, L' run parallel to each other towards the light disk of the lamp. In this way, the light disk is optimally and uniformly deflected.

The LED 2 of the element 1a with base 3 is so arranged with respect to the reflection surfaces 8 that the light rays L' emitted by the LED reach the reflection surfaces 8 without hindrance by the base 3. The reflection surfaces 8 in turn are so arranged that the rays of light reflected by them will pass by the base 3 of the LED 2 of the reflector 1.

The LEDs 2 may emit light of the same or different color. For example, one LED 2 may emit red and the other LED 2 yellow. Such a configuration is provided when the two LEDs 2 are employed for the brake light and the blinker. The two LEDs 2 are then actuated according to the desired signal function. Alternatively, of course, both LEDs may emit red or both yellow, to enhance the intensity. Alternatively again, the LEDs 2 may be used for the closure light, the fog light or the reverse light. In that case, the LEDs will emit the appropriate hue.

Fig. 4 shows an embodiment in which the two light-conducting elements 1a, 1a' are closely spaced one behind the other. The two elements 1a, 1a' are of essentially the same configuration as the element 1a according to Fig. 2. The reflection surfaces 8 on the under side 7 are spaced farther from each other than in the embodiment of Fig. 2. The reflection surfaces 8' of the element 1a are spaced farther apart than the reflection surfaces 8, and are so arranged relative to these reflection surfaces that the rays L' emanating from the bottom element 1a' exit between the rays L of the top element 1a. In the region where the light rays L' of the element 1a' reach the under side 7 of the top element 1a, there are no reflection surfaces 8. The rays L' impinge perpendicularly on the under side 7 of the element 1a and pierce it, emerging

perpendicularly from the light exit side 15 of the element 1a. Thus, in simple manner, a uniform intensive emission is assured. Since both elements 1a, 1a' have but little thickness, the corresponding lamp is distinguished also by a small structural height. The LEDs 2 may emit light of like or unlike color.

In the embodiment according to Fig. 4, an additional light-conducting element (not shown) may be provided, of similar configuration to the other two elements 1a, 1a'. The reflection surfaces of this additional light-conducting element are so arranged relative to the reflection surfaces 8, 8' that the rays reflected by them pass between the rays L, L' of the other two elements 1a, 1a'. The under side 7' of the element 1a' is even in the region of these perpendicularly incident rays. Thus, an additional enhancement of intensity can be achieved. Besides, all three LEDs may then be of different colors, so that the corresponding lamp may for example comprise a brake light, a closure light and a blinker.

Fig. 5 shows an embodiment in which the reflector 1 is arranged behind the light-conducting element 1a in beam direction. The LED 2 and the reflector 1 itself are so configured and arranged relative to each other that the rays L reflected from the reflector surface 6 pass between the reflection surfaces 8 of the element 1a. In the region of the rays L' impinging perpendicularly on the under side 7 of the element 1a, no reflection surfaces 8 are provided. The light rays L traverse the element 1a and emerge perpendicularly from its light exit side 15.

The reflector surface 6 of the reflector 1 may, as shown in the left-hand half, be of smooth configuration. Alternatively, however, as shown in the right-hand half of Fig. 5, it may be provided with optics 11, for example in the form of roller or cushion optics.

With the reflecting parts 1, 1a located one close behind the other, a high intensity of light is achieved. The reflector 1 and the light-conducting element 1a are of substantially the same diameter, and each of but little height.

The light-conducting element 1b according to Fig. 6 largely corresponds to the element according to Fig. 2. It differs from the latter in that, on the under side 7b, a cooling member 10, 10b is provided. Fig. 6 shows two embodiments, by way of example, of a cooling member. In the right-hand half of Fig. 6, the cooling member 10b is disk-shaped, covering the entire under side 7b of the light-conducting element 1b. Alternatively, as shown in the left-hand half of Fig. 6, the cooling member 10 may be of thickened configuration in the central portion 17 underneath the LED 2. This cooling member region 17 has the same diameter as the opening 13 in which the LED 2 is located. Starting out from the cooling member region 17, the thickness of the cooling member 10 diminishes as far as the outer edge of the under side 7. This diminution of thickness may be continuous or else, as shown in Fig. 6, first greater and then less towards the outer edge. In the region of the LED 2 where the greatest evolution of heat occurs, the heat can be reliably carried off by the cooling member region 17.

Incidentally, the element 1b is of like configuration as the embodiment according to Fig. 2. The cooling member may of course alternatively be provided in the embodiments according to Figs. 3 to 5.

The light-conducting element may advantageously consist of polymethyl methacrylate. The side wall 9 of the light-conducting elements 1a, 1a', 1b is advantageously provided with a reflection layer by vapor deposition, so that the light rays cannot exit from the light-conducting element laterally.

Instead of the ribbed LEDs represented and described, unribbed LEDs may be employed, likewise emitting the light laterally. Such LEDs are known and therefore are not described in more detail.

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AFFIDAVIT OF ACCURACY

STATE OF NEW YORK)
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I, the undersigned, being duly sworn, depose and state:

I am qualified to translate from the German language into the English language by virtue of being thoroughly conversant with these languages and, furthermore, having translated professionally from German into English for more than 10 years;

I have carefully made the translation appearing on the attached and read it after it was completed; and said translation is an accurate, true and complete rendition into English from the original German -language text, and nothing has been added thereto or omitted therefrom, to the best of my knowledge and belief.

Ernst van Haagen

TRANSLATION ACES, INC.

Subscribed and sworn to before me

this 3rd day of September, 2003.

Karyn L. Tasens

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Commission Expires Oct. 31, 2006